PATENT SPECIFICATION

DRAWINGS ATTACHED

884,447

Date of Application and filing Complete Specification: Jan. 3, 1958.

No. 22514/61.

Application made in Austria on Jan. 4, 1957.

Application made in Austria on Jan. 12, 1957.

(Divided out of No. 884,446.)

Complete Specification Published: Dec. 13, 1961.

Index at acceptance:—Class 83(4), T6, V(1:2).

International Classification:—B23k, p.

COMPLETE SPECIFICATION

Improvements in or relating to Metal Working

I, HEINRICH BLECHNER, of Austrian nationality, of 1/12a Jauesgasse, Vienna III, Austria, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of working on metal and to metal workpieces produced by the method.

In the specification of co-pending British Patent Application No. 347/58 (Serial No. 884,446) there is described and claimed a method of heat-treating a ferrous metal workpiece, normally non-austenitic at room temperature, by heating to above the critical point and then quenching, characterized in that the heating and quenching are effected at such a rate that an austenitic structure is retained in at least the surface portion of the treated workpiece. No claim is made herein to such a method.

According to the present invention there is provided a method of working on metal comprising the step of heating the metal to above the critical point or to above the melting point by friction caused by rapid relative movement between the metal and a tool, characterized in that the tool is a steel disc having a bevelled edge.

According to a feature of the invention successive fractional surface portions of the metal are contacted with the tool to be heated thereby.

In one embodiment of the invention the disc is rotated with a peripheral velocity of at least 80m./sec. The disc can have a smooth, ground, preferably polished or honed working surface.

According to further features of the invention the relative speed and the pressure between the metal and the tool are such that metal is removed from the treated surface.

Thus depending on the relative speeds and pressures used and on the shape of the tool the method may be adopted to perform heating treatments for instance for welding together two metal pieces, surface-finishing treatments similar to grinding, press-polishing, honing and lapping, and shaping treatments similar to milling, reaming, profiling, spinning and trueing.

The method of this ivention can be combined with the method of forming on at least the surface of the metal workpiece an austenitic structure as disclosed in the above-mentioned co-pending British Patent Specification. Profiling operations which can be performed by the method of the invention include, for example, the cutting of teeth on saws, wheels, the cutting of threads on screws, the forming of flutes on twist drills. The method can be used even for the profiling of very small precision parts such as for watches. These parts may be cut from solid stock, hardened and finished in a single operation.

For profiling operations, guides for the feed movement of the tool and/or workpiece may be employed.

The maintenance of the tools used in the method of the invention can be carried out in the manner disclosed in the above-mentioned British Patent Specification.

Specific embodiments of the invention will now be described in the following Examples, reference being had to the accompanyng drawing, in which:

Figure 1 illustrates the formation of teeth on a saw blade with the simultaneous heat-treatment of the teeth, and

Figure 2 illustrates the formation of a screw-thread with simultaneous heat-treatment of the thread.

[*Price 4s. 6d.*]

Price 25p

EXAMPLE I

Production of saw blading from steel strip 0.63 mm × 0.31 mm.

Absolute speed of tool	120 meters per second
Feed rate of tool	912 cm./sec.
Pressure between tool and workpiecc	approx. 500 grams
Absolute speed of workpiece	approx. 1.7 mm./sec.
Initial hardness of blading (micro-hardness under a load of 25 grams/sq. mm.)	700 kg./sq. mm.
Carbon content	0.9%
Micro-hardness under a load of 25 grams/sq. mm. after the treatment	1100—1150 kg./sq. mm.
Thickness of hardened layer	0.05 — 0.1 mm.

The tool used is a steel disc 135 mm. in diameter, 3 mm. thick, and having an edge bevelled at 45°. As shown in Figure 1 the edge of the disc is brought into contact with the steel strip 15 and is moved upwards through the strip thus forming one tooth. The steel strip 15 is then fed forwards one tooth pitch and the disc 1 is moved downwardly through the strip to form another tooth. The process is repeated to form the desired saw blade. Simultaneously with the formation of the teeth the saw blade is provided with a surface layer of austenitic structure which extends uniformly over the cutting and rear faces and tips of the teeth. This austenitic structure can be subsequently transformed into a hardened structure by stress, for example, by the use of the saw blade.

The hardened layer is inseparably bonded to the rest of the material, it will not crack or peel and it is resistant to corrosion. Such saws will readily cut hardened steel, and the tips of the teeth remain intact even after prolonged use.

EXAMPLE II.

Production of a screw thread.

As shown in Figure 2 a steel disc 1 having a working edge formed in accordance with the desired profile of a screw thread is caused to contact a cylindrical workpiece 14 which is axially fed and rotated at the same time. This results in the formation of a screw thread, the sides of which are shaped by the disc and are simultaneously heat-treated to provide an austenitic structure in the surface layer. The austenitic structure can be transformed into a hardened structure by subjecting the workpiece to mechanical shock.

EXAMPLE III

Surface treatment of blued steel strip 0.6 mm. thick

Absolute speed of tool	120 meters/sec.
Feed rate of tool	0
Pressure between tool and workpiece	approx. 20 grams/sq. mm.
Absolute speed of workpiece	approx. 2 mm./sec.
Initial hardness of workpiece (micro-hardness under a load of 25 grams/sq. mm.)	475 kg./sq. mm.
Carbon content	0.8%
Micro-hardness under a load of 25 grams/sq. mm. after the treatment	1100—1200 kg./sq. mm.
Thickness of hardened layer	0.08—0.1 mm.

The tool used is a thin steel disc having a bevelled edge against which the gripped steel strip is moved in the longitudinal direction. By this treatment the strip is ground and the successive surface portions contacting the disc are abruptly heated and then quenched with the result that an austenitic structure is retained in the surface of the strip.

Under stress, the austenitic surface layer transforms into a hardened layer which is bright and resistant to corrosion.

The depth of grinding can be controlled by means of the working pressure between the disc and the strip. For example with a working pressure of 500 grams and depth of grinding is 0.1 mm. and the thickness of the final hardened layer is 0.05 mm.

EXAMPLE IV

Grinding a parting tool

Absolute speed of tool	120 meters/sec.
Feed rate of tool	0
Pressure between tool and workpiece	approx. 5—10 grams/sq. mm.
Absolute speed of workpiece	0
Initial hardness of workpiece (micro-hardness under a load of 25 grams/sq. mm.)	700 kg./sq. mm.
Carbon content	0.9%
Micro-hardness under a load of 25 grams/sq. mm. after the treatment	1050 kg./sq. mm.
Thickness of hardened layer	0.01 — 0.02 mm.

Using a parting tool which has been ground and hardened according to the invention, 1350—1450 rings can be cut from steel tubing whereas only 950 rings could be cut from the tubing using parting tools of steel heat-treated by ordinary methods.

For carrying out a welding operation by the method of this invention two or more wires or metal sheets are disposed to form a butt-joint between them and are contacted under an appropriate pressure by a bevelled disc which rotates, for example, at 120 metres per second and which is moved to contact successive surface portions of the metal on both sides of the joint. The surface portions can thus be subjected to a temperature rise above the melting point of the metal to provide a very uniform and durable welded joint.

It is emphasized that all the examples can be carried out by using a simple bevelled disc rotating at high speed.

Subject to the foregoing disclaimer, WHAT I CLAIM IS: —

1. A method of working on metal comprising the step of heating the metal to above the critical point or to above the melting point by friction caused by rapid relative movement between the metal and a tool, characterized in that the tool is a steel disc having a bevelled edge.

2. A method as claimed in claim 1, wherein successive fractional surface portions of the metal are contacted with the tool to be heated thereby.

3. A method as claimed in claim 1 or claim 2, wherein the disc rotates at a peripheral velocity of at least 80 m./sec.

4. A method as claimed in any of claims 1 to 3, wherein the tool has a smooth, ground, preferably polished or honed working surface.

5. A method as claimed in any of claims 1 to 4, wherein the relative speed and the pressure between the metal and the tool are such that metal is removed from the treated surface.

6. A method as claimed in any of claims 1 to 4, comprising the steps of disposing two metal workpieces to form a butt-joint between them and successively contacting portions of the surface of the workpieces on both sides of and adjacent the joint with the steel disc to subject said portions to a temperature rise above the melting point of the metal to butt-weld the workpieces along the joint.

9. A method of working on metal substantially as hereinbefore described with reference to any one of the specific Examples.

10. Metal workpieces whenever produced by a method as claimed in any of claims 1 to 9.

HEINRICH BLECHNER
Per: Boult, Wade & Tennant,
111/112, Hatton Garden, London, E.C.1.
Chartered Patent Agents.

Leamington Spa: Printed for Her Majesty's Stationery Office, by the Courier Press.—1961.
Published by The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

884,447 COMPLETE SPECIFICATION
1 SHEET This drawing is a reproduction of the Original on a reduced scale.

Fig. 1.

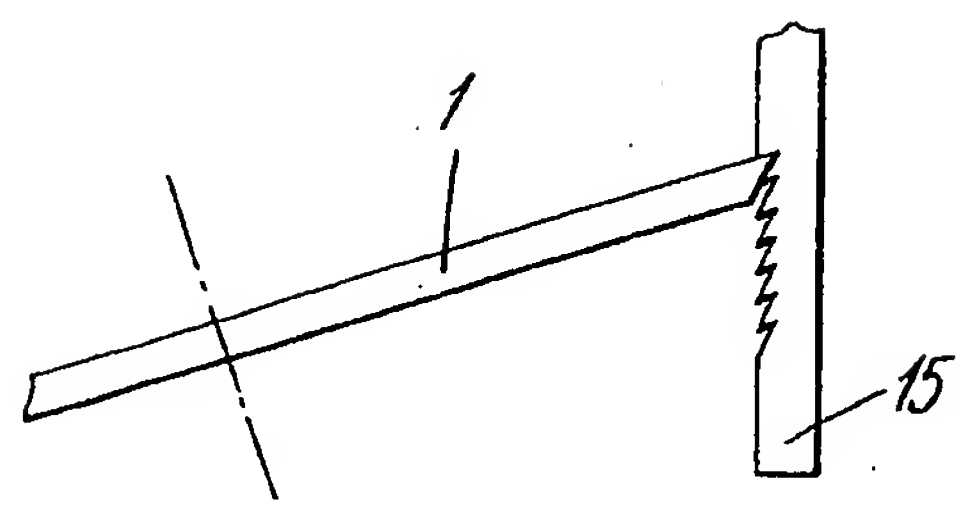

Fig. 2.